We claim:

CLAIMS

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1. An OFDM receiver, comprising:

means for recovering and sampling an rf signal into in- phase (I) and quadrature phase (Q) components of a baseband signal;

means for computing auto correlation amplitude and phase values of the I and Q components at sample points;

means for averaging the auto correlation values of the I and Q components over L symbols;

means for providing a sample number indicating an OFDM frame boundary using the averaged I and Q auto correlation values;

means providing an offset value indicative of the phase difference between the receiver and a transmitter; and

means for correcting frequency and timing offset between the receiver and the transmitter in the sample number .

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2. The OFDM receiver of Claim 1 further comprising:

means for estimating frame synchronization of the OFDM frame boundary.

3. The OFDM receiver of Claim 1 further comprising:

means for phase locking the transmitter and the receiver.

4. The OFDM receiver of Claim 1 further comprising:

means for estimating the transmitter and receiver frame offset.

5. The OFDM receiver of Claim 1 further comprising :

means responsive to the sample number and a negative phase angle of the auto correlation values for correcting for frequency synchronization, frame synchronization, and transmitter/receiver frequency offset.

6. The ODFM receiver of Claim 1 further comprising:

means responsive to a sampling clock for generating the I and Q of the received signal.

7. The OFDM receiver of Claim 1 further comprising:

means for storing the sampled I and Q components coupled to the auto correlation means and a correcting means.

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8. The OFDM receiver of Claim 1 further comprising:

means for storing the averaged auto correlation values coupled to an offset estimator and a frame synchronization estimator.

9. The OFDM receiver of Claim 1 further comprising:

a phase locked loop comprising:

means responsive to a first and a second frame synchronization signal for providing a difference signal indicative of the frame difference between the transmitter and receiver ;

means for averaging differences over a series of frames as a frame difference output;

means for processing the frame difference output through a filter ;

means responsive to the filter for integrating and rounding off the frame difference output to the nearest integer value; and

counter means responsive to the integer value providing a sample number for a desired frame boundary.

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10. The OFDM receiver of Claim 9 further comprising;

amplifier means responsive to the means for integrating and rounding off providing a coherent clock signal for the transmtter and the receiver.

11. The OFDM receiver of Claim 10 further comprising;

a programmable counter responsive to the coherent clock signal and a receiver clock for generating a receiver clock chain phase locked to the a clock in the transmitter.

12. A method of correcting timing and frequency offset in an OFDM receiver, comprising the steps of :

sampling in-phase (I) and quadrature phase (Q) components of a baeband signal;

computing auto-correlation amplitude and phase values of the I and Q components;

estimating a frame boundary of the received signal;

providing a sample number indicating a correct frame boundary;

estimating frequency and timing offset in the sample number of the receiver and a transmitter; and

correcting the frequency and timing offset in the sample number.

13. The method of Claim 12 further comprising the step of:

using the amplitude of the auto-correlation function to estimate the frame boundary.

14. The method of claim 12 further comprising the step of:

using the negative of the phase angle of the auto-correlation value as an estimated frequency offset at the sample number .

15. The method of Claim 12 further comprising the step of:

applying the estimated frame boundary to a phase-locked loop.

16. The method of Claim 12 further comprising the step of :

generating a coherent phase clock signal for the transmitter and the receiver.

17. The method of Claim 12 further comprising the steps of:

storing the I and Q component values;

providing the stored I and Q values for auto-correlation; and

providing the stored values for offset correction.

18. The method of claim 12 further comprising the steps of:

storing the auto correlation values;

providing the auto-correlation values to a frame estimator;

providing the auto-correlation values to an offset estimator.

19. The method of Claim 12 further comprising the steps of:

adjusting the phase angle of each sample in a storing means by an amount proportional to "n" where "n" is counted from a correct frame boundary.

20. The method of Claim 12 comprising the step of:

averaging the auto-correlation values over frames in a storage device.

21. In an IBOC system including a filter coupled to a converter, a first storage means coupled to the converter and to a correlator, a second storage means coupled to a frame synchronization estimator and an offset estimator, a phase locked loop coupled to the frame synchronization estimator and to the offset estimator, and an offset correction means coupled to the first storage means, the offset estimator and the phase locked loop, a method of correcting timing and frequency offset between a transmitter and a receiver in the system, comprising the steps of :

sampling in-phase (I) and quadrature phase (Q) components of a received signal;

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computing auto-correlation amplitude and phase values of the I and Q components;

estimating a frame boundary of the received signal;

providing a sample number indicating a correct frame boundary;

estimating the transmitter and receiver frequency and timing offset in the sample number; and

correcting the frequency and timing offset in the sample number.

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